The Assistant Commissioner for Patents

There is attached a sheet identified as **Annotated Copy of Specification Paragraphs Amended** and a separate sheet identified as **Clean Copy of Amended Specification Paragraphs.**

IN THE CLAIMS:

Please amend claims 2, 3, 4, 13, 14 and 15.

There is attached a sheet headed **Annotated Copy of Amended Claims Showing the Amendments**. There is also attached a sheet headed **Clean Copy of Amended Claims**.

REMARKS

Claims 1 to 16 are in the case.

Minor errors in the specification as filed have been corrected.

In particular, as a result of a software mistranslation from the electronic version of the text, the units of the fluorescence emission spectra are shown as "ηm" whereas the correct unit form is –nm--.

Corrections have been made at pages 4, 10, 11 and 16 and in claims 2, 3, 4, 13, 14 and 15.

The correction in the paragraph at page 11, lines 6 to 11 is to employ the plural Figs. for consistency with the content of the paragraph.

The correction at page 16 in the description of Fig. 16 is correction of obvious errors and for consistency with what is shown in Fig. 16.

The Assistant Commissioner for Patents

The obvious nature of the different areas is apparent and clearly noted that no new subject matter is involved. Entry of the corrections is requested.

Respectfully,

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Date: Sept. 23, 2002

Encls.

Annotated Copy of Specification Paragraphs Amended

Page 4, lines 13 to 21:

It is known that wood, pulp and paper samples exhibit inherent fluorescence. This fluorescence is the sum of the fluorescence from cellulose, hemicellulose, lignin and the lignin artefacts generated during the pulping process [7]. The fluorescence spectra of mechanical and chemical pulp sheets have been investigated in a number of studies. In general, these studies found similar broadband emission spectra for all pulp sheet samples at a given excitation wavelength. For example, the fluorescence emission spectra obtained using 350 [ηm] nm excitation light have broad, structureless bands between 375 and 600 [ηm] nm, and have maxima around 450 [ηm] nm.

Page 10, line 15 to Page 11, line 5:

Experimental results show that if a sample such as fibre-like particle is excited with a wavelength in a weak absorption region, which can range from ultraviolet to visible wavelength, the fluorescence intensity I_{FL} is found to be proportional to the sample thickness d:

$$I_{FL} \propto I_o d \ ,$$

where I_o is the intensity of excitation light. Most wood, pulp and paper samples are known to have absorption peak near 280 [ηm] nm. The excitation wavelength is chosen such that absorption in the sample, such as in an individual fibre, is weak, and sufficient fluorescence intensity can be generated for suitable detection. For example, the results shown in here were generated with the excitation in the wavelength region ranged from 360 [ηm] nm (ultraviolet) to 500 [ηm] nm (visible). In general the excitation may be in the wavelength region 5 [ηm] nm to 700 [ηm] nm, preferably 250 [ηm] nm to 600 [ηm] nm.

Page 11, lines 6 to 11:

Typical confocal cross-sectional images [3] and fluorescence images of wood pulp fibres immersed in water were generated simultaneously as shown in Figs. 2a, 2a1, 2b and 2b1. The fibre's gray level in the fluorescence images is proportional to the fluorescence intensity. The vertical wall thickness and fluorescence intensity profiles generated from the images in [Fig.] <u>Figs.</u> 2a, 2a1, 2b and 2b1 are shown to be consistent as presented in Figs. 3a and 3b.

Page 16, line 17 to Page 17, line 9:

Figure 16 shows the fluorescence intensities per unit length $I_{FI/L}$ generated by using the long [LW] <u>(LW)</u> versus short [(LW)] <u>(SW)</u> wavelength barrier / long-pass / band-pass filters for individual wood pulp fibres from three pulps of different Kappa number. These data were generated with 365 [ηm] <u>nm</u> excitation from a mercury arc lamp, and two long-pass filters with 420 [ηm] <u>nm</u> for short and 520 [ηm] <u>nm</u> for long cut-on wavelengths. The slopes of the fitted lines, which are shown to be different, correspond to the mean ratios of intensities between long and short wavelength filters for the three pulps. The values of the slopes are plotted against the measured Kappa numbers of these pulps by standard methods [10] as shown in Fig. 17. The coefficient of determination R^2 of 0.98 shows a strong correlation between this ratio and the Kappa number of wood pulp fibres. Therefore, this ratio can be used for the Kappa number of individual fibres. The present invention, therefore, will provide a process for determining the uniformity of Kappa number in a pulp. As also shown in Fig. 16, the different R^2 values for the fitted lines indicate the heterogeneity of Kappa number in the pulps. Pulps with higher Kappa number are shown to be more heterogeneous. Furthermore, this new invention can determine lignin content variability not only between but also within individual fibres.

Clean Copy of Amended Specification Paragraphs

Page 4, lines 13 to 21:

It is known that wood, pulp and paper samples exhibit inherent fluorescence. This fluorescence is the sum of the fluorescence from cellulose, hemicellulose, lignin and the lignin artefacts generated during the pulping process [7]. The fluorescence spectra of mechanical and chemical pulp sheets have been investigated in a number of studies. In general, these studies found similar broadband emission spectra for all pulp sheet samples at a given excitation wavelength. For example, the fluorescence emission spectra obtained using 350 nm excitation light have broad, structureless bands between 375 and 600 nm, and have maxima around 450 nm.

B1

Page 10, line 15 to Page 11, line 5:

Experimental results show that if a sample such as fibre-like particle is excited with a wavelength in a weak absorption region, which can range from ultraviolet to visible wavelength, the fluorescence intensity I_{FL} is found to be proportional to the sample thickness d:

$$I_{FL} \propto I_o d \ ,$$

where I_o is the intensity of excitation light. Most wood, pulp and paper samples are known to have absorption peak near 280 nm. The excitation wavelength is chosen such that absorption in the sample, such as in an individual fibre, is weak, and sufficient fluorescence intensity can be generated for suitable detection. For example, the results shown in here were generated with the excitation in the wavelength region ranged from 360 nm (ultraviolet) to 500 nm (visible). In general the excitation may be in the wavelength region 5 nm to 700 nm, preferably 250 nm to 600 nm.

B2

Page 11, lines 6 to 11:

B3

Typical confocal cross-sectional images [3] and fluorescence images of wood pulp fibres immersed in water were generated simultaneously as shown in Figs. 2a, 2a1, 2b and 2b1. The fibre's gray level in the fluorescence images is proportional to the fluorescence intensity. The vertical wall thickness and fluorescence intensity profiles generated from the images in Figs. 2a, 2a1, 2b and 2b1 are shown to be consistent as presented in Figs. 3a and 3b.

Page 16, line 17 to Page 17, line 9:

B4

Figure 16 shows the fluorescence intensities per unit length $I_{FI/L}$ generated by using the long (LW) versus short (SW) wavelength barrier / long-pass / band-pass filters for individual wood pulp fibres from three pulps of different Kappa number. These data were generated with 365 nm excitation from a mercury arc lamp, and two long-pass filters with 420 nm for short and 520 nm for long cut-on wavelengths. The slopes of the fitted lines, which are shown to be different, correspond to the mean ratios of intensities between long and short wavelength filters for the three pulps. The values of the slopes are plotted against the measured Kappa numbers of these pulps by standard methods [10] as shown in Fig. 17. The coefficient of determination R^2 of 0.98 shows a strong correlation between this ratio and the Kappa number of wood pulp fibres. Therefore, this ratio can be used for the Kappa number of individual fibres. The present invention, therefore, will provide a process for determining the uniformity of Kappa number in a pulp. As also shown in Fig. 16, the different R^2 values for the fitted lines indicate the heterogeneity of Kappa number in the pulps. Pulps with higher Kappa number are shown to be more heterogeneous. Furthermore, this new invention can determine lignin content variability not only between but also within individual fibres.

Annotated Copy of Amended Claims

Claims 2, 3, 4, 13, 14 and 15:

2. (Amended) A method according to claim 1 wherein at least a single wavelength of excitation light in the range 5 [ηm] nm to 700 [ηm] nm is applied in step a) and a physical parameter is determined in step c).

3. (Amended) A method according to claim 2 wherein said excitation light has a wavelength of 250 [ηm] nm to 600 [ηm] nm.

4. (Amended) A method according to claim 3 wherein said wavelength is 360 [ηm] nm to 500 [ηm] nm.

13. (Amended) An apparatus according to claim 12 wherein said means i) applies excitation light at at least a single wavelength in the range 5[η] nm to 700 [ηm] nm, and means ii) determines a physical parameter of individual fibre particles of the wood pulp.

14. (Amended) An apparatus according to claim 13 wherein said wavelength is 250 [ηm] nm to 600 [ηm] nm.

15. (Amended) An apparatus according to claim 13 wherein said wavelength is 360 [ηm] nm to 500 [ηm] nm.

Clean Copy of Amended Claims

Claims 2, 3, 4, 13, 14 and 15:

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2. A method according to claim 1 wherein at least a single wavelength of excitation light in the range 5 nm to 700 nm is applied in step a) and a physical parameter is determined in step c).

B5

3. A method according to claim 2 wherein said excitation light has a wavelength of 250 nm to 600 nm.

4. A method according to claim 3 wherein said wavelength is 360 nm to 500 nm.

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13. An apparatus according to claim 12 wherein said means i) applies excitation light at at least a single wavelength in the range 5 nm to 700 nm, and means ii) determines a physical parameter of individual fibre particles of the wood pulp.

B6

14. An apparatus according to claim 13 wherein said wavelength is 250 nm to 600 nm.

15. An apparatus according to claim 13 wherein said wavelength is 360 nm to 500 nm.
